

CLAIMS

What is claimed is:

1. A method for designing a system, comprising:
 - determining minimum and maximum delay budgets for connections; and
 - 5 selecting routing resources for the connections in response to the minimum and maximum delay budgets.
2. The method of Claim 1, wherein determining minimum and maximum delay budgets comprises considering lower and upper delay limits of routed connections based on potential
10 routing possibilities.
3. The method of Claim 2, wherein lower delay limits of the routed connections are determined based on an initial selection of routing resources that minimizes connection delays and ignores shorted signals.
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4. The method of Claim 1, wherein determining minimum and maximum delay budgets comprises starting with initial estimates of final routed delay.
5. The method of Claim 4, wherein estimates of final routed delay are determined based
20 on an initial selection of routing resources for connections that minimizes connection delay.
6. The method of Claim 4, wherein estimates of final routed delay are determined based on an initial selection of routing resources for connections that ignores shorted signals.

7. The method of Claim 1, wherein determining minimum and maximum delay budgets for the connections comprises finding a set of connection delays that attempt to satisfy the short-path and long-path timing constraints.

5 8. The method of Claim 1, wherein determining minimum and maximum delay budgets for the connections comprises allocating short-path and long-path slack.

9. The method of Claim 7, wherein allocating the delay in order to satisfy the long-path and short-path timing constraints comprises:

10 performing short-path timing analysis to determine short-path slack values;
fixing any short-path violations determined by the short-path timing analysis;
performing long-path timing analysis to determine long-path slack values; and
fixing any long-path violations determined by the long-path timing analysis.

15 10. The method of Claim 9, wherein fixing any short-path violations comprises adding delay in response to the short-path slack values and connection weightings.

11. The method of Claim 9, wherein the connection weightings are determined by a unit weighting scheme.

20 12. The method of Claim 9, wherein the connection weighting is determined based on how much delay can be added before a practical limit is reached or all relevant violations are resolved.

25 13. The method of Claim 9, wherein fixing any long-path violations comprises subtracting delay in response to the long-path slack values and connection weightings.

14. The method of Claim 8, wherein allocating the long-path and short-path slack comprises:

- 5 performing long-path timing analysis to determine long-path slack values;
- allocating long-path slack determined by the long-path timing analysis;
- performing short-path timing analysis to determine short-path slack values; and
- allocating short-path slack determined by the short-path timing analysis.

15. The method of Claim 14, wherein allocating long-path slack comprises adding delay
10 to temporary delays in response to the long-path slack values and connection weightings.

16. The method of Claim 15, wherein the connection weightings are determined by a unit weighting scheme.

15 17. The method of Claim 15, wherein the connection weighting is determined based on how much delay can be added before a practical limit is reached or all relevant slack is allocated.

18. The method of Claim 14, wherein allocating short-path slack comprises subtracting delay from temporary delays in response to the short-path slack values and connection
20 weightings.

19. The method of Claim 1, wherein selecting routing resources for connections in response to the minimum and maximum delay budgets comprises re-selecting the routing resources for connections whose current proposed routes do not meet the minimum and
25 maximum delay budgets.

20. The method of Claim 1, wherein selecting routing resources for connections in response to the minimum and maximum delay budgets comprises re-selecting the routing resources for connections that are shorted.

5 21. The method of Claim 1, wherein selecting routing resources for connections in response to the minimum and maximum delay budgets comprises decreasing minimum delay budgets based on the number of routing iterations that have occurred.

10 22. The method of Claim 1, wherein selecting routing resources for connections in response to the minimum and maximum delay budgets comprises increasing maximum delay budgets based on the number of routing iterations that have occurred.

15 23. The method of Claim 1, wherein selecting routing resources for connections in response to the minimum and maximum delay budgets comprises utilizing a cost function.

24. The method of Claim 23, wherein the cost function scores routing resources as candidates for selection in completing a connection route.

25 25. The method of Claim 24, wherein the lowest cost routing resource is efficiently tracked via use of a heap.

26. The method of Claim 24, wherein the cost function for a routing resource is based, in part, on the delay of the respective routing resource.

25 27. The method of Claim 24, wherein the cost function for a routing resource is based, in part, on a prediction of the delay to reach the destination from the respective routing resource.

28. The method of Claim 24, wherein the cost function for a routing resource is based, in part, on how the total estimated routing delay of the connection if the routing resource is used compares with the minimum and maximum delay budget of the connection.

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29. The method of Claim 24, wherein the cost function for a routing resource is based, in part, on the number of competing signals that want to use the respective routing resource.

30. The method of Claim 29, further comprising increasing the penalty associated with
10 several competing signals wanting to use the same resource in the cost function as connection re-routing attempts occur.

31. The method of Claim 30, further comprising increasing the penalty associated with several competing signals wanting to use the same resource in the cost function, based, in part, on
15 how many signals wanted to use the resource in previous routing attempts.

32. The method of Claim 30, further comprising increasing the penalty associated with several competing signals wanting to use the same resource in the cost function, based, in part, on how many routing iterations have occurred.

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33. A machine-readable medium having stored thereon sequences of instructions, the sequences of instructions including instructions which, when executed by a processor, causes the processor to perform:

25 determining minimum and maximum delay budgets for connections; and
 selecting routing resources for the connections in response to the minimum and maximum delay budgets.

34. The machine-readable medium of Claim 33, wherein determining minimum and maximum delay budgets comprises considering lower and upper delay limits of routed connections based on potential routing possibilities.

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35. The machine-readable medium of Claim 34, wherein lower delay limits of the routed connections are determined based on an initial selection of routing resources that minimizes connection delays and ignores shorted signals.

10 36. The machine-readable medium of Claim 33, wherein determining minimum and maximum delay budgets comprises starting with initial estimates of final routed delay.

15 37. The machine-readable medium of Claim 36, wherein estimates of final routed delay are determined based on an initial selection of routing resources for connections that minimizes connection delay.

38. The machine-readable medium of Claim 36, wherein estimates of final routed delay are determined based on an initial selection of routing resources for connections that ignores shorted signals.

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39. The machine-readable medium of Claim 33, wherein determining minimum and maximum delay budgets for the connections comprises finding a set of connection delays that attempt to satisfy the short-path and long-path timing constraints.

25 40. The machine-readable medium of Claim 33, wherein determining minimum and maximum delay budgets for the connections comprises allocating short-path and long-path slack.

41. The machine-readable medium of Claim 39, wherein allocating the delay in order to satisfy the long-path and short-path timing constraints comprises:

- 5 performing short-path timing analysis to determine short-path slack values;
- fixing any short-path violations determined by the short-path timing analysis;
- performing long-path timing analysis to determine long-path slack values; and
- fixing any long-path violations determined by the long-path timing analysis.

42. The machine-readable medium of Claim 40, wherein allocating the long-path and
10 short-path slack comprises:

- performing long-path timing analysis to determine long-path slack values;
- allocating long-path slack determined by the long-path timing analysis;
- performing short-path timing analysis to determine short-path slack values; and
- allocating short-path slack determined by the short-path timing analysis.

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43. The machine-readable medium of Claim 33, wherein selecting routing resources for connections in response to the minimum and maximum delay budgets comprises re-selecting the routing resources for connections whose current proposed routes do not meet the minimum and maximum delay budgets.

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44. The machine-readable medium of Claim 33, wherein selecting routing resources for connections in response to the minimum and maximum delay budgets comprises re-selecting the routing resources for connections that are shorted.

45. The machine-readable medium of Claim 33, wherein selecting routing resources for connections in response to the minimum and maximum delay budgets comprises decreasing minimum delay budgets based on the number of routing iterations that have occurred.

5 46. The machine-readable medium of Claim 33, wherein selecting routing resources for connections in response to the minimum and maximum delay budgets comprises increasing maximum delay budgets based on the number of routing iterations that have occurred.

10 47. The machine-readable medium of Claim 33, wherein selecting routing resources for connections in response to the minimum and maximum delay budgets comprises utilizing a cost function.

15 48. A system designer, comprising:
 a slack allocator unit that generates minimum and maximum delay budgets for connections from long-path and short-path timing constraints; and
 a routing unit that selects routing resources in a system to route the connections in response to the minimum and maximum delay budgets.

20 49. The system designer of Claim 48, wherein the slack allocator comprises a timing analysis unit that generates long-path and short-path slack values for the connections in response to connection delays and the long-path and short-path timing constraints.

25 50. The system designer of Claim 48, wherein the slack allocator comprises a delay adjustment unit that modifies a set of temporary connection delays in order to attempt to satisfy the long-path and short-path timing constraints.

51. The system designer of Claim 48, wherein the slack allocator comprises a delay adjustment unit that modifies a set of temporary connection delays to allocate long-path and short-path slack.

5 52. The method of Claim 21, wherein decreasing minimum delay budgets based on the number of routing iterations that have occurred comprises decreasing the minimum delay budgets of connections that are competing for routing resources other connections want.

10 53. The method of Claim 22, wherein increasing maximum delay budgets based on the number of routing iterations that have occurred comprises increasing the maximum delay budgets of connections that are competing for routing resources other connections want.

54. The method of Claim 24, wherein the cost function for a routing resource is based, in part, on the delay incurred reaching the respective routing resource from the connection source.

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55. The method of Claim 27, wherein the prediction of the delay to reach the destination from the respective routing resource is based, in part, on the minimum and maximum delay budget.